

# ABSTRACT

Cryptocurrency markets are highly volatile, making it challenging for investors to make informed decisions. To address this, we present a system that provides real-time notifications and recommendations based on historical price data and machine learning forecasts. The system utilizes Python libraries such as requests, pandas, scikit-learn, and Flask to fetch data from the CoinGecko API, perform linear regression analysis for price forecasting, and deliver recommendations via a web interface. The notification component continuously monitors price changes for a list of cryptocurrencies, fetching historical data and forecasting future prices using linear regression. When significant price changes are detected, the system sends notifications containing current and forecasted prices to users, facilitating timely decision-making.

The recommendation component fetches real-time cryptocurrency data using the CoinGecko API and calculates recommendations based on predefined price thresholds. If a cryptocurrency's price exceeds certain thresholds, the system suggests whether to buy, sell, or hold that asset. These recommendations are then communicated to users through a web interface built with Flask and Socket.IO, providing a user-friendly way to access insights and make investment decisions.

Overall, our system offers a comprehensive solution for cryptocurrency investors, combining machine learning-based price forecasting with real-time recommendations to enhance decision-making in a dynamic market environment.

**Keywords:** Coin Gecko API, linear regression, Notification, Recommendation.

# INTRODUCTION

The cryptocurrency market has emerged as a dynamic and lucrative investment opportunity, attracting a diverse range of investors seeking high returns. However, navigating this volatile landscape requires access to timely and insightful information to make informed decisions. Traditional methods of analysis often fall short in capturing the rapid fluctuations and complex trends characteristic of cryptocurrencies. To address this challenge, we present a comprehensive solution: the Cryptocurrency Notification and Recommendation System. Leveraging the power of machine learning and real-time data processing, our system aims to empower investors with actionable insights and timely notifications to navigate the cryptocurrency market effectively.

we integrate two key components: a notification system and a recommendation engine. The notification system continuously monitors price changes for a curated list of cryptocurrencies, leveraging historical price data and machine learning forecasting techniques to predict future price movements. When significant price changes are detected, users receive instant notifications. Complementing the notification system is our recommendation engine, which evaluates real-time cryptocurrency data to provide actionable insights based on predefined price thresholds. By analysing price trends and comparing them against predetermined benchmarks, the recommendation engine generates buy, sell, or hold recommendations for each cryptocurrency. These recommendations are then delivered to users through an intuitive web interface, facilitating informed decision-making in a rapidly evolving market environment. Through the seamless integration of machine learning algorithms, real-time data processing, and user-friendly interfaces, our Cryptocurrency Notification and Recommendation System represents a holistic approach to cryptocurrency investment. By providing users with timely notifications and actionable recommendations, we aim to empower investors with the tools they need to navigate the complexities of the cryptocurrency market with confidence and agility.

## ALGORITHMS

### **Linear Regression:**

Linear regression is employed to forecast cryptocurrency prices based on historical price data.

The historical price data is used to train a linear regression model, where the input features are time indices and the target variable is the cryptocurrency price.

Once the model is trained, it can be used to predict future prices based on the extrapolation of historical trends.

This algorithm is implemented using the Linear Regression class from the **sklearn.linear\_model** module.

### **Threshold-based Analysis:**

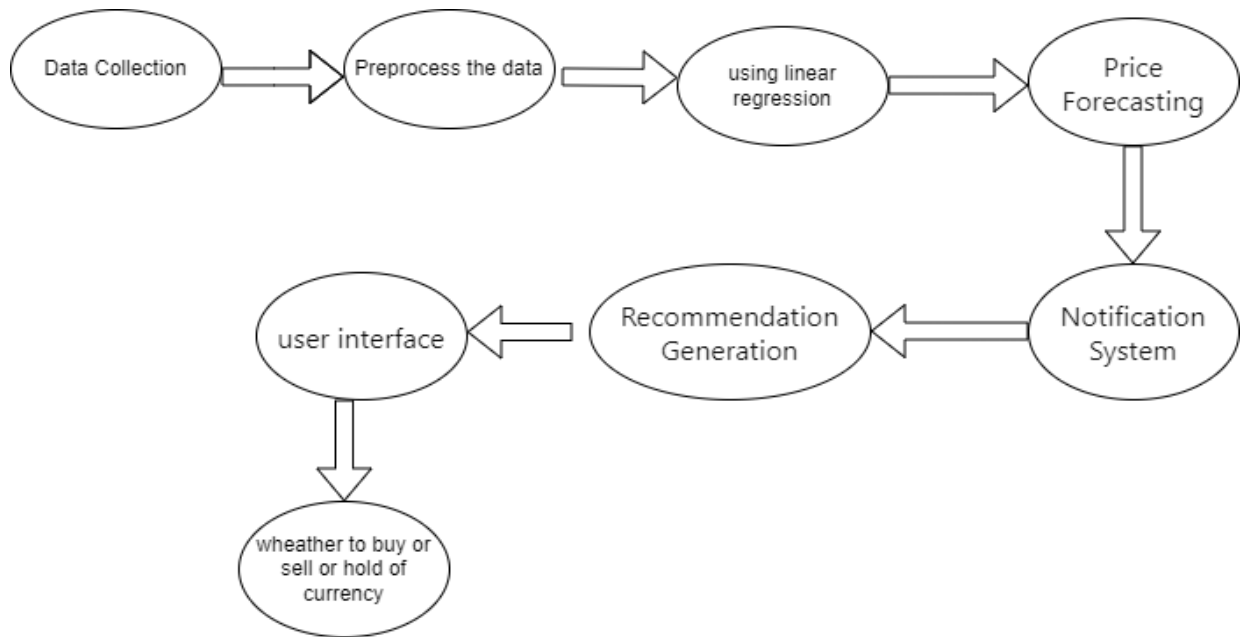
For generating recommendations, a simple threshold-based approach is adopted.

Predefined price thresholds are set for each cryptocurrency, defining specific price levels at which buy, sell, or hold recommendations are triggered.

When the current price of a cryptocurrency crosses these predefined thresholds, the recommendation engine generates corresponding buy, sell, or hold recommendations.

This approach provides a straightforward way to categorize cryptocurrency price movements and guide investment decisions.

## DESIGN



**Figure 2:** Designing of the cryptocurrency notification and recommendation

# PERFORMANCE METRICS

## **Accuracy of Price Forecasting:**

Mean Absolute Error (MAE): Measures the average absolute difference between forecasted and actual cryptocurrency prices.

Root Mean Squared Error (RMSE): Provides a measure of the typical deviation of forecast errors.

R-squared (R<sup>2</sup>): Indicates the proportion of the variance in cryptocurrency prices that is predictable by the linear regression model.

## **Effectiveness of Recommendations:**

Precision: Measures the proportion of correctly identified buy, sell, or hold recommendations out of the total recommendations made.

Recall: Quantifies the ability of the recommendation engine to correctly identify all relevant buy, sell, or hold opportunities.

F1 Score: Harmonic mean of precision and recall, providing a balanced measure of recommendation effectiveness.

## **Timeliness of Notifications:**

Notification Latency: Measures the time elapsed between significant price changes or forecasted trends and the delivery of notifications to users.

Real-time Accuracy: Assesses the ability of the notification system to provide timely alerts without significant delays.

## **User Engagement and Satisfaction:**

User Feedback Ratings: Collects feedback from users regarding the usefulness, accuracy, and usability of the system.

User Retention Rate: Measures the percentage of users who continue to use the system over time, indicating satisfaction and value.

## LITERATURE SURVEY

In[1], Luisanna Cocco, Roberto Tonelli, Michele Marchesi, The title which is Predictions of bitcoin prices through machine learning based frameworks and the Dataset is cryptocurrency market and methodology is Bayesian Neural Network and merits and demits of this are Solve both a classification problem and a regression problem by different ML algorithms, Recurrent Neural Network, Tree classifier and the SVM algorithm and Solve both a classification problem and a regression problem by different ML algorithms, Recurrent Neural Network, Tree classifier and the SVM algorithm and there is 76% of accuracy.

In[2], Otabek Sattarov ORCID, Azamjon Muminov ORCID, Cheol Won Lee, Hyun Kyu Kang, Ryumduck Oh, Junho Ahn, Hyung Jun Oh and Heung Seok Jeon, The title of this is Recommending Cryptocurrency Trading Points with Deep Reinforcement Learning Approach the data is taken from Bitcoin (BTC), Litecoin (LTC), and Ethereum (ETH)—crypto coins' historical data the methodology they used for this is deep reinforcement learning (DRL) the merits and demerits are he investor got 14.4% net profits within one month. Similarly, tests on Litecoin and Ethereum also finished with 74% and 41% profit, respectively and we lose money instead of earning. The accuracy of it is 90%.

In[3], Jaehyun Park and Yeong-Seok Seo, The title of this is A Deep Learning-Based Action Recommendation Model for Cryptocurrency Profit Maximization the methodology used is empirical mode decomposition (EMD) algorithm new input features such as sellProfit, buyProfit, and maxProfit merits and demerits are the proposed model showed approximately 13% to 21% improvement over existing methods and is statistically significant and this result would involve a class imbalance issue because positive classes were not successfully predicted at all and its accuracy are 13% and 21%.

In[4], Ashutosh Shankhdhar<sup>1</sup>, Akhilesh Kumar Singh<sup>2</sup>, Suryansh Naugraiya<sup>3</sup> and Prathmesh Kumar Saini the title is Bitcoin Price Alert and Prediction System using various Models the dataset are crypto-compare website. Theil-Sen Regression, Huber Regression) and deep learning algorithms like (LSTM, GRU) close (closing value of bitcoin), open (opening value of bitcoin), high (highest value of bitcoin in a day), low (lowest value of bitcoin reached in a day) the merits and demerits are The results show that GRU has highest R<sup>2</sup> of 99.2% while Huber Regression has lowest execution time of 0.0002 seconds and are less complex than LSTM because they GRU do not have an output gate but they contain a forget gate. And the accuracy is 52.77%.

In[5], Prosper Lamothe-Fernández, David Alaminos, \*ORCID, Prosper Lamothe-López and Manuel A. Fernández-Gámez

, Deep Learning Methods for Modeling Bitcoin Price the dataset is Bitcoin, Historical data Recurrent neural networks (RNN) and Deep Recurrent Convolution Neural Network (DRCNN) Deep Neural Decision Trees (DNDT). The merits and demerits are The model with the highest accuracy is that of deep recurrent convolution neural network (DRCNN) with 97.34%, followed by the model of deep neural decision trees (DNDT) method with 96.94% on average by regions and since different standard factors of the relationship between supply and demand cannot be applied. The accuracy is 97.34%.

In[6], Mohammed Abdullah Ammer<sup>1,2</sup> ORCID and Theyazn H. H. Aldhyani<sup>1,3</sup>, \*ORCID, Deep Learning Algorithm to Predict Cryptocurrency Fluctuation Prices: Increasing Investment Awareness. The dataset CoinMarketCap.com and methodology is long short-term memory (LSTM) algorithm. the merits and demerits are increasing investment awareness in the context of digital currencies such as Ethereum and XRP. The use of deep learning algorithms for predicting cryptocurrency prices is highlighted, offering potential benefits such as improved precision and accuracy in forecasting models. And the use of only four cryptocurrencies for testing the proposed prediction model. Additionally, the study does not provide accurate prediction models for all cryptocurrencies and does not conduct an evaluation of the proposed model using data for all

cryptocurrencies and the accuracy is 0.00184

In[7], Takuya Shintate and Lukáš Pichl, Trend Prediction Classification for High-Frequency Bitcoin Time Series with Deep Learning the dataset is OkCoin Bitcoin market (CNY and USD) time series at a minute frequency. The dataset was provided commercially by Kaiko data.high-frequency Bitcoin time series using deep learning, specifically the random sampling method (RSM),The dataset includes OHLC price time series in CNY and USD, with transaction volume dynamics in Bitcoin.the merits and demerits are Addressing Non-Stationarity, Mitigating Class Imbalance,Improved Classification, Extraction of Deterministic Patterns, Outperformance of LSTM, Novel Application and Data Limitations, Model Complexity, Overfitting, Hyperparameters Sensitivity,Interpertability,Market Dynamics and accuracy 0.6264.

In[8], Rasoul Amirzadeh, Asef Nazari, and Dhananjay Thiruvady. Applying Artificial Intelligence in Cryptocurrency Markets: A Survey and dataset Cryptocurrency Markets Cryptocurrencies rely on a decentralised peer-to-peer network, using blockchain technology to store all transactions in a decentralised public ledger merits and demerits are Decentralization,Security,Digital platform and there is no specific mention of demerits related to blockchain technology and cryptocurrency projects in the provided context and there is 85% of accuracy.

In[9], Abdullah H. Al-Nefaie and Theyazn H. H. Aldhyani, Bitcoin Price Forecasting and Trading: Data Analytics Approaches and dataset are The data generated between 1 January 2021 and 16 June 2022 were collected as a sample from Market Watch Determining whether there is a statistically significant correlation between the prediction and observation values is crucial and merits and demerits are the bitcoin transaction graph was used by other academics [37] to predict bitcoin prices and Many people have made considerable amounts of money by speculating on cryptocurrencie and accuracy is 8.44.

In[10], Abdullah H. Al-Nefaie and Theyazn H. H. Aldhyani, Bitcoin Price Forecasting and Trading: Data

Analytics Approaches and dataset are The data generated between 1 January 2021 and 16 June 2022 were collected as a sample from Market Watch Determining whether there is a statistically significant correlation between the prediction and observation values is crucial and merits and demerits are the bitcoin transaction graph was used by other academics [37] to predict bitcoin prices and Many people have made considerable amounts of money by speculating on cryptocurrencies.the accuracy Mean Squared Error (MSE) of 8.444 GRU model showed the highest MSE of 0.016518. In the testing phase, the MLP model demonstrated exceptionally low prediction errors with an MSE of 0.000109, while the GRU model achieved an MSE of 0.03354. MLP model of 98.90% and the GRU model 96.35%.

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S. N O	Author	Title	Dataset	methodology	Merits	Demerits	Accuracy
1.	Luisanna Cocco, Roberto Tonelli, Michele Marchesi	Predictions of bitcoin prices through machine learning based frameworks	cryptocurrency market	Bayesian Neural Network	Solve both a classification problem and a regression problem by different ML algorithms, Recurrent Neural Network, Tree classifier and the SVM algorithm.	This approach is not always applicable due to the long training times of some models.	76%
2.	Otabek Sattarov ORCID, Azamjon Muminov ORCID, Cheol Won Lee, Hyun Kyu Kang, Ryumduck Oh, Junho Ahn, Hyung Jun Oh and Heung Seok Jeon, *	Recommending Cryptocurrency Trading Points with Deep Reinforcement Learning Approach	Bitcoin (BTC), Litecoin (LTC), and Ethereum (ETH)—cryptocoin's historical data	deep reinforcement learning (DRL) It did not apply any selection method	the investor got 14.4% net profits within one month. Similarly, tests on Litecoin and Ethereum also finished with 74% and 41% profit, respectively.	we lose money instead of earning.	90%
3.	Jaehyun Park and Yeong-Seok Seo *	A Deep Learning-Based Action Recommendation Model for Cryptocurrency Profit Maximization	cryptocurrency price data	empirical model deposition (EMD) algorithm new input features such as sellProfit, buy Profit, and maxProfit	the proposed model showed approximately 13% to 21% improvement over existing methods and is statistically significant.	this result would involve a class imbalance issue because positive classes were not successfully predicted at all.	13% to 21% improvement
4.	Ashutosh Shankhd	Bitcoin Price Alert	crypto-compare website	Theil-Sen Regression	The results show that GRU has highest R2 of	GRU are less complex than LSTM because	52.77%



	har1, Akhilesh Kumar Singh2 , Suryansh Naugrai ya3 and Prathmesh Kumar Saini	and Prediction System using various Models		on, Huber Regression) and deep learning algorithms like (LSTM, GRU) close (closing value of bitcoin), open (opening value of bitcoin), high (highest value of bitcoin in a day), low(lowest value of bitcoin reached in a day)	99.2% while Huber Regression has lowest execution time of 0.0002 seconds.	they do not have an output gate but they contain a forget gate.	
5.	Prosper Lamothe - Fernández, David Alamino s, *ORCID, Prosper Lamothe -López and Manuel A. Fernández-Gómez	Deep Learning Methods for Modeling Bitcoin Price	Bitcoin , Historical data	Recurrent neural networks (RNN) and Deep Recurrent Convolution Neural Network (DRCNN) Deep Neural Decision Trees (DNDT)	The model with the highest accuracy is that of deep recurrent convolution neural network (DRCNN) with 97.34%, followed by the model of deep neural decision trees (DNDT) method with 96.94% on average by regions.	since different standard factors of the relationship between supply and demand cannot be applied in	97.34%
6.	Mohammed Abdullah Ammer	Deep Learning Algorithm to Predict	CoinMarketCap.com	long short-term memory	increasing investment awareness in the context of digital currencies such as	the use of only four cryptocurrencies for testing the proposed	MSE training - 0.00360

	1,2ORCID andThey azn H. H. Aldhyan i 1,3,*ORCID	Cryptocurrency Fluctuation Prices: Increasing Investment Awareness		(LSTM) algorithm.	Ethereum and XRP. The use of deep learning algorithms for predicting cryptocurrency prices is highlighted, offering potential benefits such as improved precision and accuracy in forecasting models.	prediction model. Additionally, the study does not provide accurate prediction models for all cryptocurrencies and does not conduct an evaluation of the proposed model using data for all cryptocurrencies.	testing =0.0999. The RMSE for training was 0.0579 and for testing was 0.04289. The NRMS E for training was 0.08877 and for testing was 0.00184
7.	Takuya Shintate and Lukáš Pichl.	Trend Prediction Classification for High-Frequency Bitcoin Time Series with Deep Learning	OkCoin Bitcoin market (CNY and USD) time series at a minute frequency. The dataset was provided commercially by Kaiko data	high-frequency Bitcoin time series using deep learning, specifically the random sampling method (RSM), The dataset includes OHLC price time series in CNY and USD, with transacti	Addressing Non-Stationarity, Mitigating Class Imbalance, Improved Classification, Extraction of Deterministic Patterns, Outperformance of LSTM, Novel Application	Data Limitations, Model Complexity, Overfitting, Hyperparameters Sensitivity,Interpretability,Market Dynamics	The RSM model achieved an accuracy of 0.6264

				on volume dynamic s in Bitcoin.			
8.	Rasoul Amirzadeh, Asef Nazari, and Dhananjay Thiruvadhy.	Applying Artificial Intelligence in Cryptocurrency Markets: A Survey	Cryptocurrency Markets.	Cryptocurrencies rely on a decentralised peer-to-peer network, using blockchain technology to store all transactions in a decentralised public ledger.	Decentralization, Security, Digital platform.	there is no specific mention of demerits related to blockchain technology and cryptocurrency projects in the provided context.	85%
9.	Abdullah H. Al-Nefaie and Theyazn H. H. Aldhyan i..	Bitcoin Price Forecasting and Trading: Data Analytics Approaches.	The data generated between 1 January 2021 and 16 June 2022 were collected as a sample from Market Watch.	Determining whether there is a statistically significant correlation between the prediction and observation values is crucial.	the bitcoin transaction graph was used by other academics [37] to predict bitcoin prices.	Many people have made considerable amounts of money by speculating on cryptocurrencies.	there is no specific mention of demerits related to blockchain technology and cryptocurrency projects in the provided context .
10 .	Abdullah H. Al-Nefaie and Theyazn H. H.	Bitcoin Price Forecasting and Trading: Data	The data generated between 1 January 2021 and 16 June	Determining whether there is a statistically	the bitcoin transaction graph was used by other academics [37] to predict bitcoin prices.	Many people have made considerable amounts of money by speculating on	Mean Squared Error (MSE) of 8.444

	Aldhyan i.	Analytic s Approac hes	2022 were collected as a sample from Market Watch	significa nt correlati on between the predictio n and observat ion values is crucial.		cryptocurrencies.	GRU model showed the highest MSE of 0.0165 18. In the testing phase, the MLP model demonst rated excepti onally low predicti on errors with an MSE of 0.0001 09, while the GRU model achieve d an MSE of 0.0335 4. MLP model of 98.90% and the GRU model 96.35% testing.
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## PROPOSED METHODOLOGY

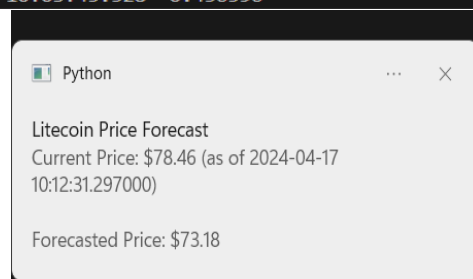
- The proposed methodology aim is to overcome the existing methodology of the bitcoin notification and recommendation using the advanced machine learning techniques.
- In this project we are implementing the bitcoin notify with more accuracy and also gets fast notification as if a bitcoin value changes and also gives the current price and time stamp, forecast prices.
- We are also implementing the recommendation for the bitcoin based upon the fixed value which compares the value increase or decrease.
- These can be done by the process Data collection, Real time bitcoin validation.
- Algorithms which involve here are Linear regression, threshold analysis.

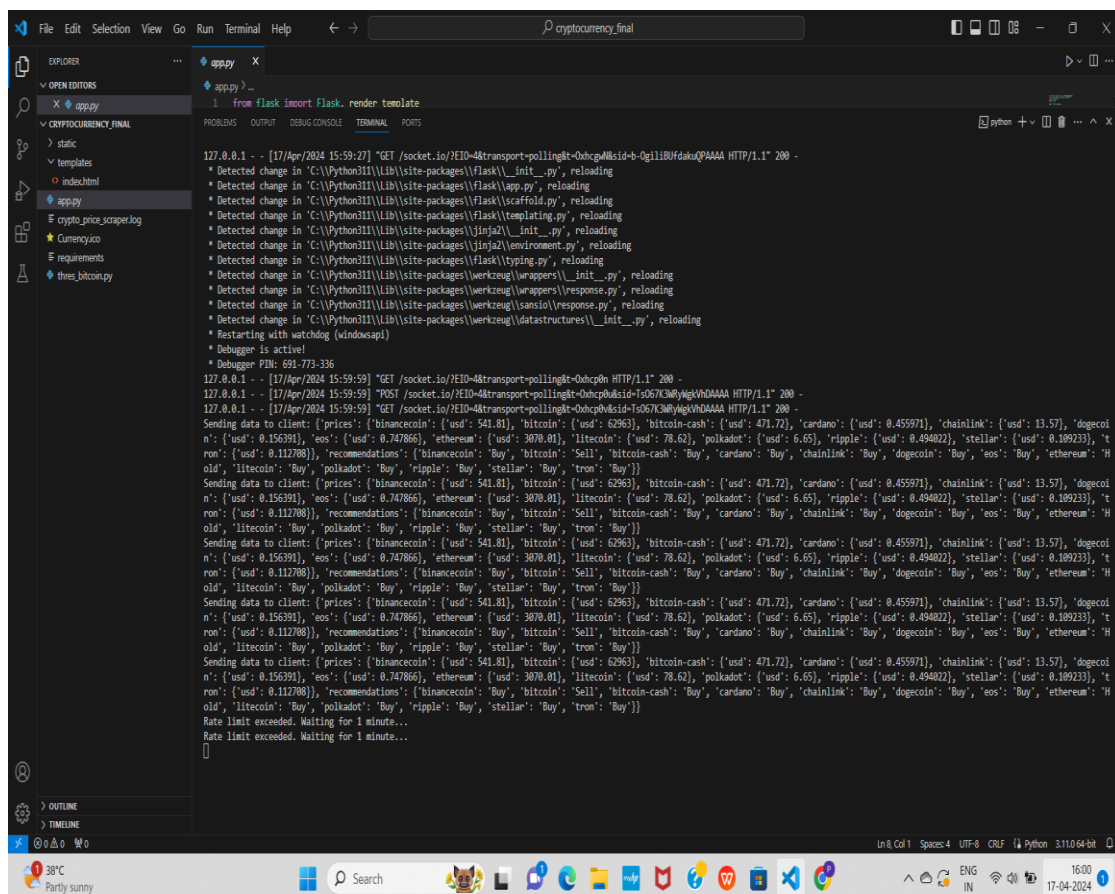
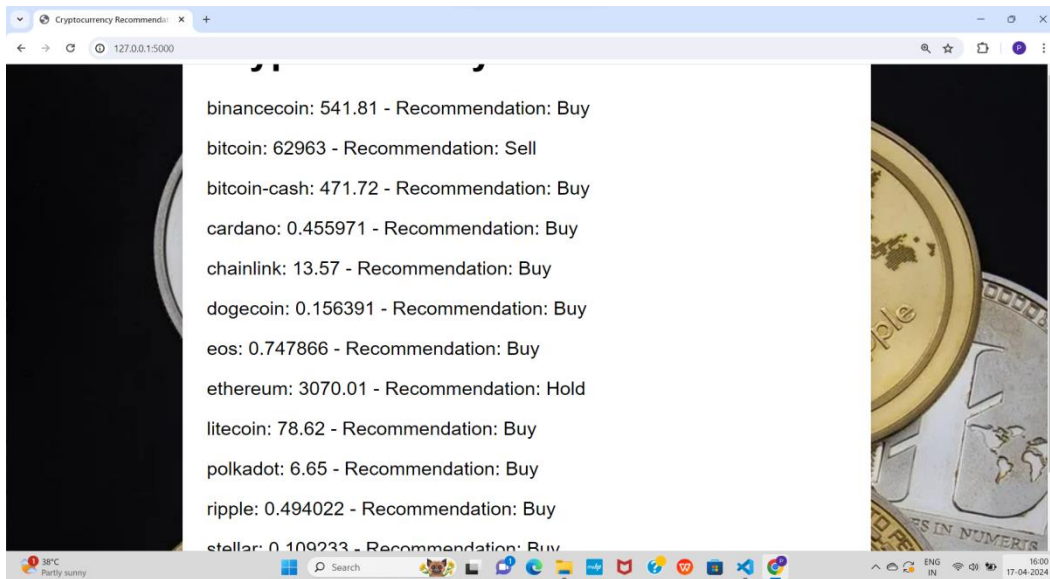
## EXPERIMENTAL RESULTS AND DISCUSSION

```
PS C:\Users\HP\Desktop\cryptocurrency_final> python thres_bitcoin.py
Processed data for bitcoin:
      timestamp      price
0   2024-04-10 11:05:48.486  68977.179417
1   2024-04-10 12:06:41.021  69044.999108
2   2024-04-10 13:03:31.871  67916.638623
3   2024-04-10 14:00:18.353  68151.497338
4   2024-04-10 15:00:43.920  68652.140364
..
..
163 2024-04-17 06:02:52.899  63930.254417
164 2024-04-17 07:02:16.343  63882.819955
165 2024-04-17 08:01:05.354  63534.523865
166 2024-04-17 09:01:28.460  63350.625136
167 2024-04-17 10:02:59.520  63342.304736

[168 rows x 2 columns]
Forecasted prices for bitcoin:
[62064.51812683 62012.57031908 61960.62251133 61908.67470357
 61856.72689582 61804.77908807 61752.83128032]
Processed data for ethereum:
      timestamp      price
0   2024-04-10 11:02:14.420  3521.326531
1   2024-04-10 12:07:00.675  3516.325868
2   2024-04-10 13:03:58.959  3438.303988
3   2024-04-10 14:02:27.569  3457.894969
4   2024-04-10 15:04:13.905  3485.891261
..
..
163 2024-04-17 06:01:05.130  3089.871158
164 2024-04-17 07:01:12.205  3093.576818
165 2024-04-17 08:00:04.365  3084.669914
166 2024-04-17 09:00:56.723  3074.714385
167 2024-04-17 10:02:48.850  3079.692631

[168 rows x 2 columns]
Forecasted prices for ethereum:
[2963.00540714 2959.58174242 2956.15807769 2952.73441296 2949.31074824
 2945.88708351 2942.46341878]
Processed data for cardano:
      timestamp      price
0   2024-04-10 11:05:39.616  0.577654
1   2024-04-10 12:03:41.158  0.577710
2   2024-04-10 13:04:52.236  0.566246
3   2024-04-10 14:05:04.390  0.568943
4   2024-04-10 15:04:55.071  0.572901
..
..
163 2024-04-17 06:02:10.358  0.458273
164 2024-04-17 07:01:57.027  0.457166
165 2024-04-17 08:01:33.239  0.458176
166 2024-04-17 09:07:56.463  0.456113
167 2024-04-17 10:03:45.528  0.456596
```





## CONCLUSION

The Cryptocurrency Notification and Recommendation System represents a comprehensive solution designed to empower cryptocurrency investors with timely insights and actionable recommendations in navigating the dynamic and volatile cryptocurrency market. Through the integration of machine learning algorithms, real-time data processing, and user-friendly interfaces, the system aims to address the key challenges faced by investors, including price forecasting, decision-making, and staying informed about market trends.

the Cryptocurrency Notification and Recommendation System represents a valuable tool for investors seeking to navigate the complexities of the market with confidence and agility. By leveraging advanced technology user-centric design principles, the users with the insights and recommendation.

## BIBLIOGRAPHY:

### Paper References:

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**Sci-hub:** <https://sci-hub.hkvisa.net/>